



# BEST OUTCOMES FOR SSI/SSOPI FOR OPEN HERNIA REPAIR

ACHQC QUALITY IMPROVEMENT SUMMIT 2024

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# DISCLOSURES

None

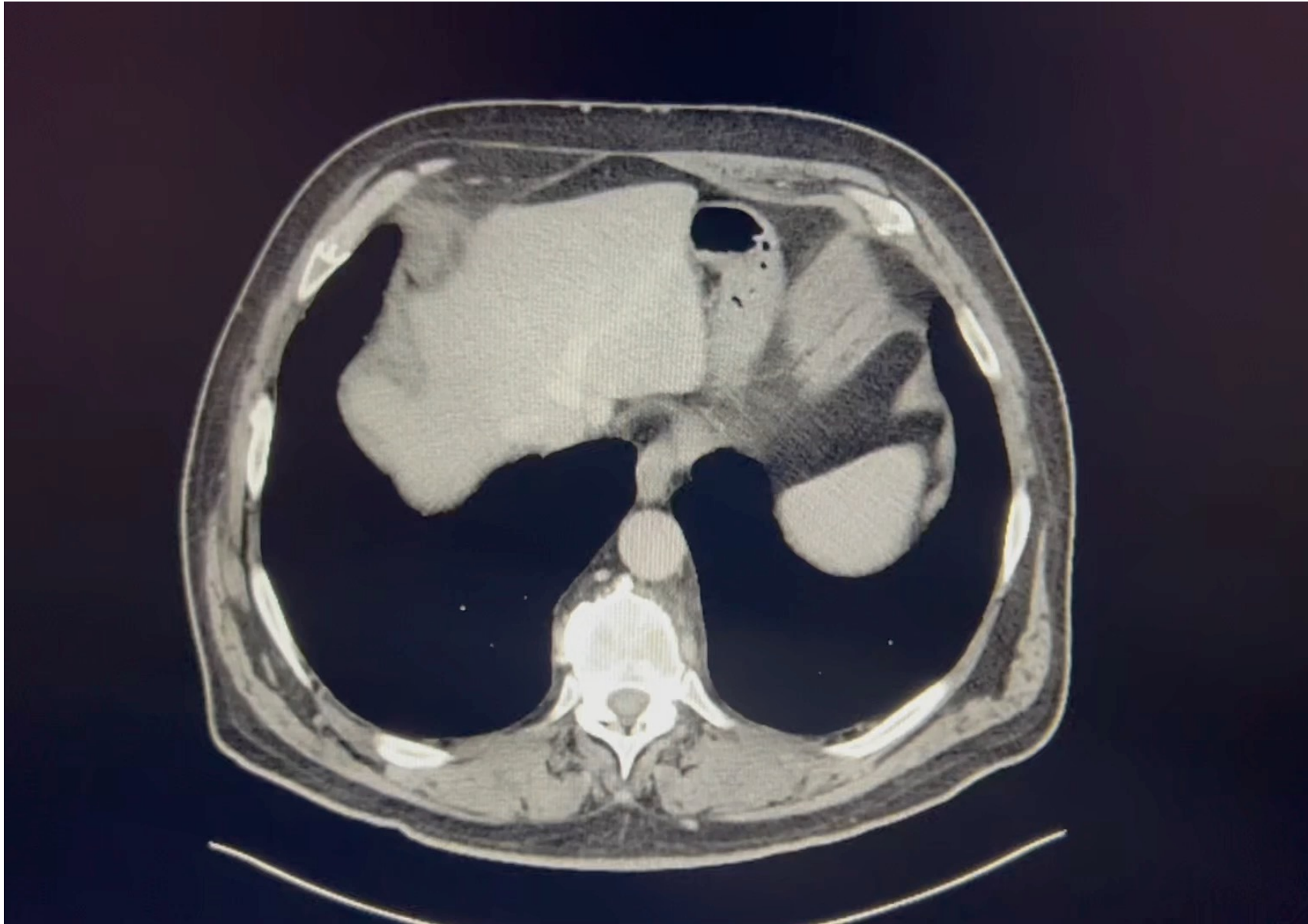
# LEARNING OBJECTIVE

- Discuss different techniques for SSI mitigation post hernia repair
- Evaluate available evidence
- TIPS and Tricks for practice implementation

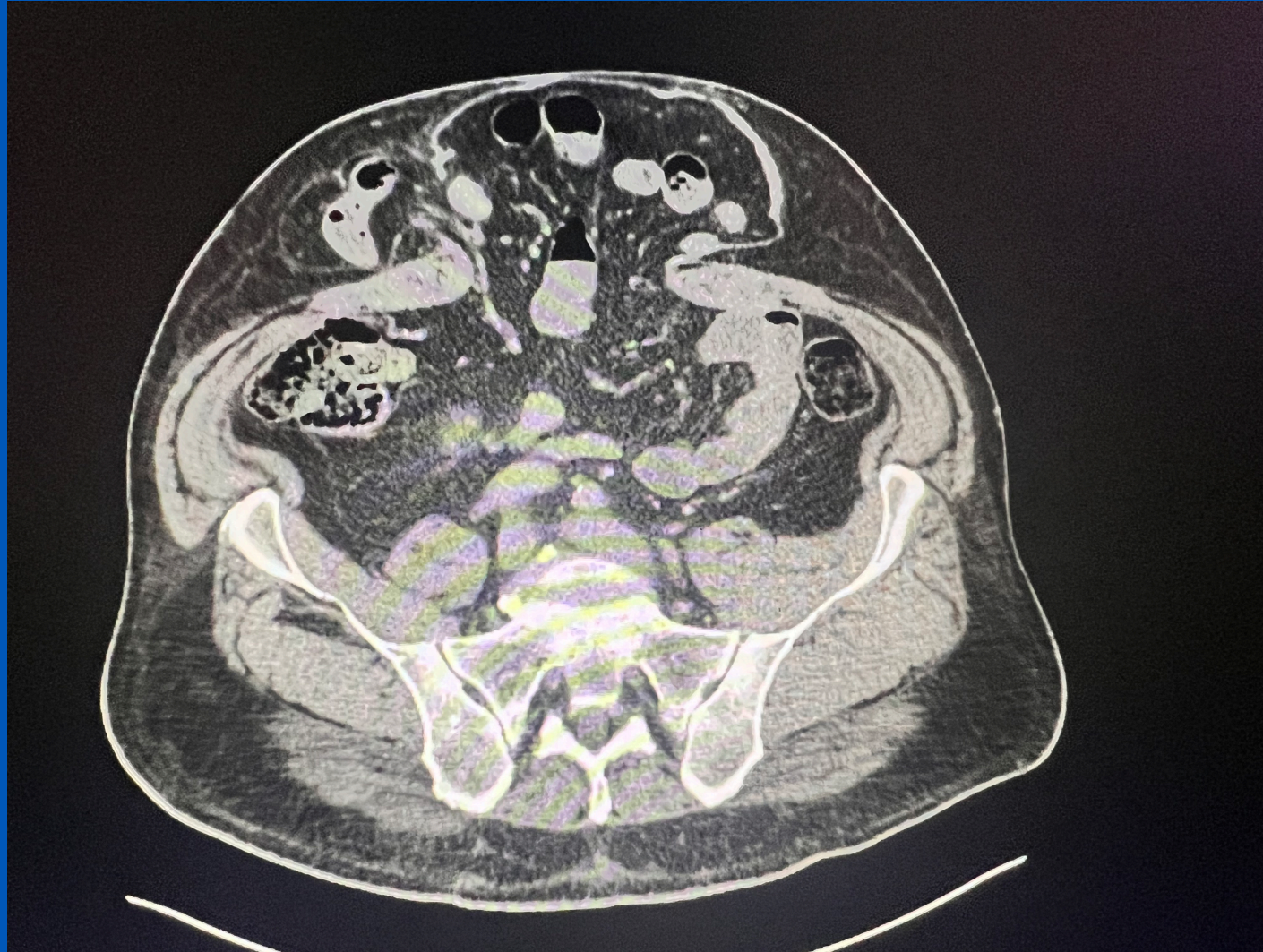
## Lets start out with a case:

63 y/o M presents with a 2x recurrent ventral hernia

- Initial repair: Ventralex patch
- Recurrence: removed Ventralex patch and placed 8cm Ventralex mesh
- Now has large recurrence
- Underwent LSG 2023, previous MIS RIH repair
- BMI 33, non-smoker, non-diabetic



# HOW WOULD YOU MANAGE THE SOFT TISSUE?



# MANAGING THE SOFT TISSUE

## WHAT IS THE EVIDENCE


Does active smoking really matter before ventral hernia repair? An AHSQC analysis ☆☆☆★

Clayton C. Petro, MD\*, Ivy N. Haskins, MD, Luciano Tastaldi, MD, Chao Tu, MS, David M. Krpata, MD, Michael J. Rosen, MD, FACS, Ajita S. Prabhu, MD, FACS

Does a “hernia center” label provide better 30-day outcomes following elective ventral hernia repair?: An analysis of the ACHQC database

Ivy N. Haskins<sup>a,\*</sup>, Li-Ching Huang<sup>b</sup>, Sharon Phillips<sup>b</sup>, Benjamin Poulouse<sup>c</sup>, Arielle J. Perez<sup>d</sup>

**Outcomes of light and midweight synthetic mesh use in clean-contaminated and contaminated ventral incisional hernia repair: an ACHQC comparative analysis**

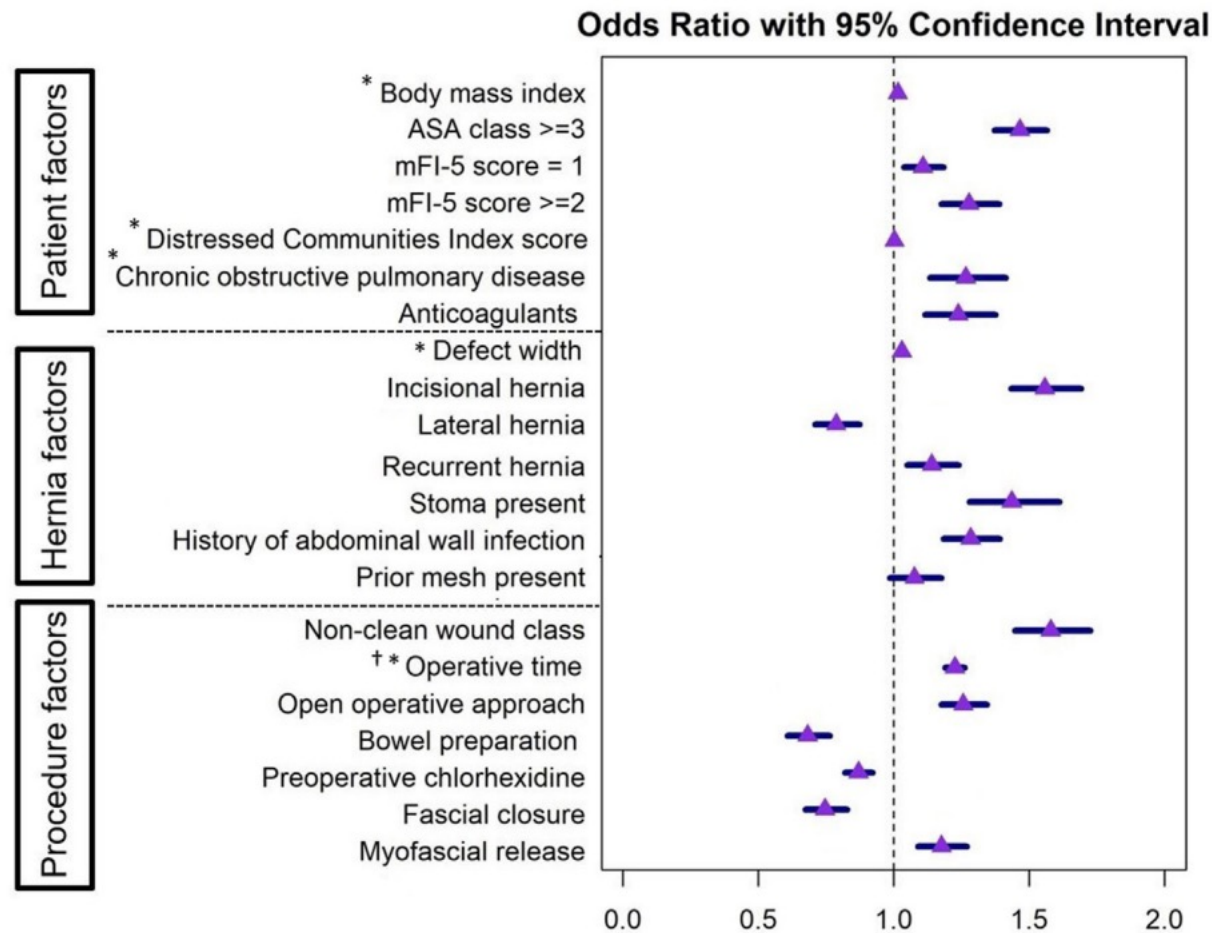
Monica E. Polcz<sup>1</sup> · Richard A. Pierce<sup>1</sup> · Molly A. Olson<sup>2</sup> · Joseph Blankush<sup>1</sup> · Meredith C. Duke<sup>1</sup> · Joseph Broucek<sup>1</sup> · Joel F. Bradley III<sup>1</sup> 

**Single-staged retromuscular abdominal wall reconstruction with mesh at the time of ostomy reversal: are we crossing the line? An ACHQC Analysis**

Megan Melland-Smith<sup>1</sup> · Benjamin Miller<sup>1</sup> · Clayton Petro<sup>1</sup> · Lucas Beffa<sup>1</sup> · Ajita Prabhu<sup>1</sup> · David Krpata<sup>1</sup> · Molly LaBelle<sup>2</sup> · Robert Tamer<sup>3</sup> · Michael Rosen<sup>1</sup>

# The association of hernia-specific and procedural risk factors with early complications in ventral hernia repair: ACHQC analysis

Mazen R. Al-Mansour<sup>a,\*</sup>, Delaney D. Ding<sup>a</sup>, Celeste G. Yergin<sup>a</sup>, Robert Tamer<sup>b</sup>, Li-Ching Huang<sup>c</sup>



Al-Mansour, Mazen R., et al. "The association of hernia-specific and procedural risk factors with early complications in ventral hernia repair: ACHQC analysis." *The American Journal of Surgery* (2024).

# Managing the Posterior Space

## Reducing the incidence of surgical site infection after ventral hernia repair: Outcomes from the RINSE randomized control trial

**Table 4**  
Outcomes.

Characteristics	Control	G + C	P-value
<b>30-day Outcomes</b>			
Completed 30-day follow-up	111 (88.8)	110 (88.0)	
Length of stay mean ± SD	5.2 ± 2.94	5.76 ± 4.9	0.642
median (IQR)	5.0 (4.0–6.08)	5.0 (3.0–7.0)	
Surgical Site Infection (%)	11/111 (9.91)	10/110 (9.09)	0.836
Superficial (%)	7 (6.3)	4 (3.6)	
Deep (%)	4 (3.6)	5 (4.5)	
Organ Space (%)	1 (0.9)	1 (0.9)	
SSI Requiring Procedural Intervention (%)	8/111 (7.21)	8/110 (7.27)	0.985
Wound debridement (%)	0 (0)	3 (2.7)	
Wound opening (%)	5 (4.5)	5 (4.5)	
Suture excision (%)	1 (0.9)	0 (0)	
Percutaneous drainage (%)	2 (1.8)	2 (1.8)	
Mesh removal (%)	0 (0)	0 (0)	
Surgical Site Occurrence (%)	13/111 (11.71)	15/110 (13.64)	0.667

Cellulitis (%)	3 (2.7)	2 (1.8)	
Non-healing wound (%)	1 (0.9)	0 (0)	
Soft tissue ischemia/necrosis (%)	0 (0)	2 (1.8)	
Wound serous drainage (%)	3 (2.7)	0 (0)	
Seroma (%)	4 (3.6)	9 (8.2)	
Infected seroma (%)	2 (1.8)	1 (0.9)	
Hematoma (%)	1 (0.9)	1 (0.9)	
Exposed synthetic mesh (%)	1 (0.9)	2 (1.8)	
Infected synthetic mesh (%)	0 (0)	1 (0.9)	
SSO Requiring Procedure Intervention (%)	4 (3.6)	4 (3.6)	0.99
Wound debridement (%)	1 (0.9)	1 (0.9)	
Wound opening (%)	3 (2.7)	4 (3.6)	
Percutaneous drainage (%)	1 (0.9)	0 (0)	
Partial mesh removal (%)	1 (0.9)	0 (0)	
Complete mesh removal (%)	0 (0)	0 (0)	
Readmission (%)	11/111 (10.91)	7/110 (6.36)	0.335
Reoperation (%)	6/111 (5.41)	1/110 (0.91)	0.056
Wound complication (%)	2 (1.8)	1 (0.9)	
Postoperative bleeding (%)	2 (1.8)	0 (0)	
Bowel obstruction (%)	2 (1.8)	0 (0)	

Warren, Jeremy A., et al. "Reducing the incidence of surgical site infection after ventral hernia repair: Outcomes from the RINSE randomized control trial." *The American Journal of Surgery* (2024).

# Managing the Posterior Space

Reducing the incidence of surgical site infection after ventral hernia repair:  
Outcomes from the RINSE randomized control trial

90-day Outcomes			
Surgical site infection (%)	5/72 (6.94)	3/79 (3.80)	0.389
Superficial (%)	4 (5.56)	1 (1.27)	
Deep (%)	2 (2.78)	2 (2.53)	
Organ space (%)	0 (0)	0 (0)	
SSI Requiring Procedural Intervention (%)	2 (2.78)	1 (1.27)	0.506
Wound debridement (%)	1 (1.39)	0 (0)	
Wound opening (%)	2 (2.78)	1 (1.27)	
Mesh removal (%)	0 (0)	0 (0)	
Surgical site occurrence (%)	8/72 (11.11)	11/79 (13.92)	0.603
Cellulitis (%)	1 (1.39)	2 (2.53)	
Non-healing wound (%)	1 (1.39)	3 (3.80)	
Fascial disruption (%)	1 (1.39)	0 (0)	
Soft tissue ischemia/necrosis (%)	1 (1.39)	1 (1.27)	
Wound serous drainage (%)	3 (4.17)	4 (5.06)	
Wound purulent drainage (%)	1 (1.39)	0 (0)	
Seroma (%)	2 (2.78)	4 (5.06)	
Hematoma (%)	1 (1.39)	1 (1.27)	
SSO Requiring Procedural Intervention (%)	2/72 (2.78)	2/79 (2.53)	0.925
Wound debridement (%)	1 (1.39)	0 (0)	
Wound opening (%)	1 (1.39)	0 (0)	
Percutaneous drainage (%)	1 (1.39)	2 (2.53)	
Mesh removal (%)	0 (0)	0 (0)	

Warren, Jeremy A., et al. "Reducing the incidence of surgical site infection after ventral hernia repair: Outcomes from the RINSE randomized control trial." *The American Journal of Surgery* (2024).



**HOW TO OPTIMIZE PATIENT**



**WHERE TO PLACE THE MESH**



**WHAT MESH TO USE**



**HOW TO MANAGE THE DEEP SPACE**

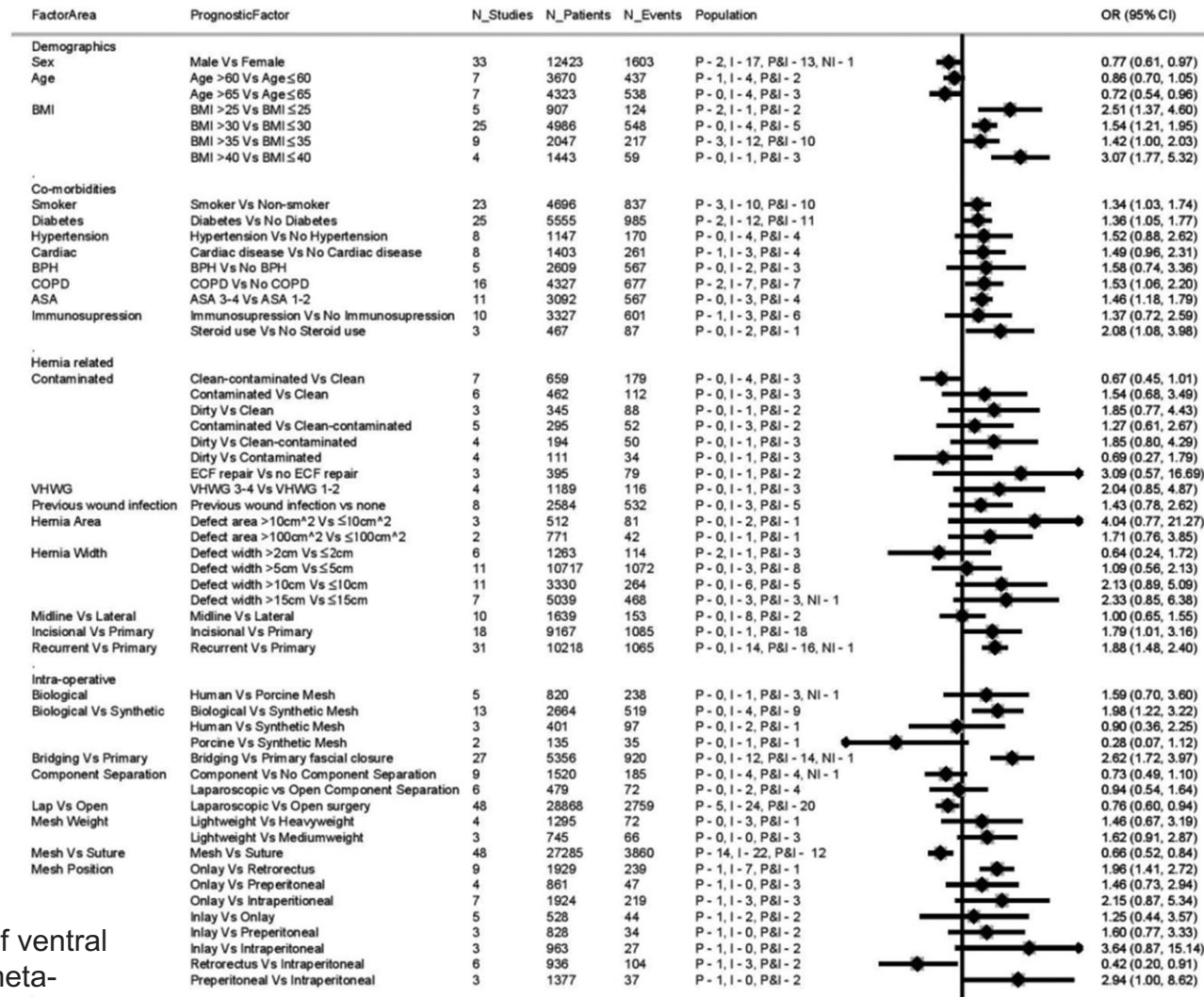


What do you do about the  
subcutaneous space

# WHY DOES THIS MATTER

## Identifying predictors of ventral hernia recurrence: systematic review and meta-analysis

S. G. Parker<sup>1</sup>\*, S. Mallett<sup>2</sup>, L. Quinn<sup>2</sup>, C. P. J. A. A. O. Plumb<sup>4</sup>, A. C. J. Windsor<sup>1</sup>, L. Archer<sup>5</sup> an



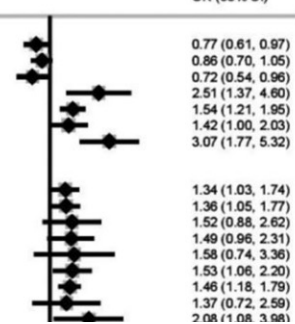
Parker, S. G., et al. "Identifying predictors of ventral hernia recurrence: systematic review and meta-analysis." *BJS open* 5.2 (2021): zraa071.

# WHY DOES THIS MATTER?

## Identifying predictors of ventral hernia recurrence: systematic review and meta-analysis

S. G. Parker <sup>1,\*</sup>, S. Mallett<sup>2</sup>, L. C. A. A. O. Plumb<sup>4</sup>, A. C. J. Windsor<sup>1</sup>,

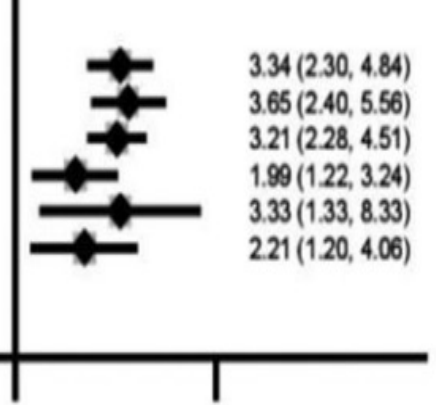
Factor/Area	Prognostic Factor	N_Studies	N_Patients	N_Events	Population	OR (95% CI)
Demographics						
Sex	Male Vs Female	33	12423	1603	P - 2, I - 17, P&I - 13, NI - 1	0.77 (0.61, 0.97)
Age	Age >60 Vs Age ≤60	7	3670	437	P - 1, I - 4, P&I - 2	0.86 (0.70, 1.05)
	Age >65 Vs Age ≤65	7	4323	538	P - 0, I - 4, P&I - 3	0.72 (0.54, 0.96)
BMI	BMI >25 Vs BMI ≤25	5	907	124	P - 2, I - 1, P&I - 2	2.51 (1.37, 4.60)
	BMI >30 Vs BMI ≤30	25	4986	548	P - 0, I - 4, P&I - 5	1.54 (1.21, 1.95)
	BMI >35 Vs BMI ≤35	9	2047	217	P - 3, I - 12, P&I - 10	1.42 (1.00, 2.03)
	BMI >40 Vs BMI ≤40	4	1443	59	P - 0, I - 1, P&I - 3	3.07 (1.77, 5.32)
Co-morbidities						
Smoker	Smoker Vs Non-smoker	23	4696	837	P - 3, I - 10, P&I - 10	1.34 (1.03, 1.74)
Diabetes	Diabetes Vs No Diabetes	25	5555	985	P - 2, I - 12, P&I - 11	1.36 (1.05, 1.77)
Hypertension	Hypertension Vs No Hypertension	8	1147	170	P - 0, I - 4, P&I - 4	1.52 (0.88, 2.62)
Cardiac	Cardiac disease Vs No Cardiac disease	8	1403	261	P - 1, I - 3, P&I - 4	1.49 (0.96, 2.31)
BPH	BPH Vs No BPH	5	2609	567	P - 0, I - 2, P&I - 3	1.58 (0.74, 3.36)
COPD	COPD Vs No COPD	16	4327	677	P - 2, I - 7, P&I - 7	1.53 (1.06, 2.20)
ASA	ASA 3-4 Vs ASA 1-2	11	3092	567	P - 0, I - 3, P&I - 4	1.46 (1.18, 1.79)
Immunosuppression	Immunosuppression Vs No Immunosuppression	10	3327	601	P - 1, I - 3, P&I - 6	1.37 (0.72, 2.59)
	Steroid use Vs No Steroid use	3	467	87	P - 0, I - 2, P&I - 1	2.08 (1.08, 3.98)



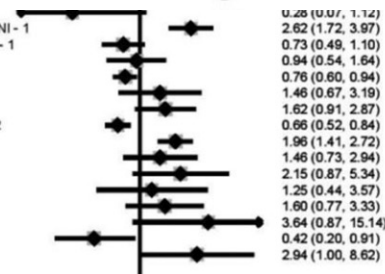
Post-operative  
Complication  
SSO  
Wound infection  
Seroma  
Haematoma  
Wound Dehiscence

NOTE: Weights are from random effects analysis

Complication Vs No Complication	6	2187	204	P - 0, I - 3, P&I - 3
SSO Vs No SSO	10	1749	243	P - 0, I - 6, P&I - 4
Wound infection Vs No Wound infection	24	5668	1004	P - 2, I - 10, P&I - 12
Seroma Vs No Seroma	8	1577	220	P - 0, I - 4, P&I - 4
Haematoma Vs No Haematoma	2	417	177	P - 0, I - 2, P&I - 0
Wound Dehiscence Vs No Wound Dehiscence	2	669	61	P - 0, I - 1, P&I - 1



Factor/Area	Prognostic Factor	N_Studies	N_Patients	N_Events	Population	OR (95% CI)
Bridging Vs Primary	Incision vs Synthetic mesh	2	130	30	P - 0, I - 1, P&I - 1	0.26 (0.07, 1.12)
Component Separation	Bridging Vs Primary fascial closure	27	5356	920	P - 0, I - 12, P&I - 14, NI - 1	2.62 (1.72, 3.97)
	Component Vs No Component Separation	9	1520	185	P - 0, I - 4, P&I - 4, NI - 1	0.73 (0.49, 1.10)
	Laparoscopic vs Open Component Separation	6	479	72	P - 0, I - 2, P&I - 4	0.94 (0.54, 1.64)
Lap Vs Open	Laparoscopic Vs Open surgery	48	28868	2759	P - 5, I - 24, P&I - 20	0.76 (0.60, 0.94)
Mesh Weight	Lightweight Vs Heavyweight	4	1295	72	P - 0, I - 3, P&I - 1	1.46 (0.67, 3.19)
	Lightweight Vs Mediumweight	3	745	66	P - 0, I - 0, P&I - 3	1.62 (0.91, 2.87)
Mesh Vs Suture	Mesh Vs Suture	48	27285	3860	P - 14, I - 22, P&I - 12	0.66 (0.52, 0.84)
Mesh Position	Onlay Vs Retrorectus	9	1929	239	P - 1, I - 7, P&I - 1	1.96 (1.41, 2.72)
	Onlay Vs Preperitoneal	4	861	47	P - 1, I - 0, P&I - 3	1.46 (0.73, 2.94)
	Onlay Vs Intraabdominal	7	1924	219	P - 1, I - 3, P&I - 3	2.15 (0.87, 5.34)
	Inlay Vs Onlay	5	528	44	P - 1, I - 2, P&I - 2	1.25 (0.44, 3.57)
	Inlay Vs Preperitoneal	3	828	34	P - 1, I - 0, P&I - 2	1.60 (0.77, 3.33)
	Inlay Vs Intraabdominal	3	963	27	P - 1, I - 0, P&I - 2	3.64 (0.87, 15.14)
	Retrorectus Vs Intraabdominal	6	936	104	P - 1, I - 3, P&I - 2	0.42 (0.20, 0.91)
	Preperitoneal Vs Intraabdominal	3	1377	37	P - 1, I - 0, P&I - 2	2.94 (1.00, 8.62)



Parker, S. G., et al. "Identifying predictors of ventral hernia recurrence: systematic review and meta-analysis." *BJS open* 5.2 (2021): zraa071.

# MANAGING THE SUBQ

## WHAT IS THE EVIDENCE

**Does negative pressure wound therapy applied to closed incisions following ventral hernia repair prevent wound complications and hernia recurrence?  
A systematic review and meta-analysis**

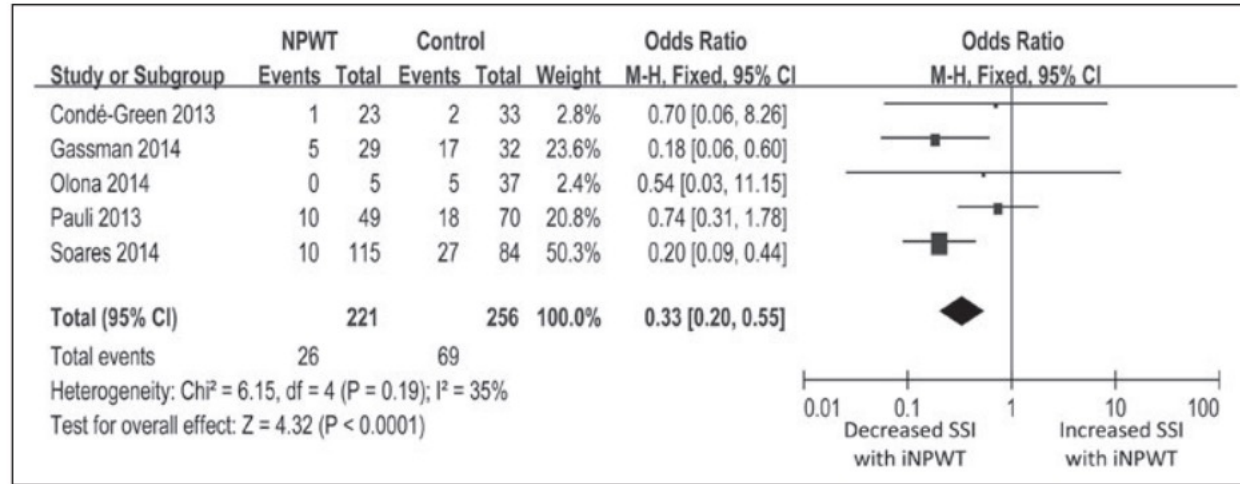
Author (ref), year	Incisional NPWT		Conventional Dressing		Demographic difference between two groups	Ventral hernia repair technique and reinforcement material used	Wound Complications	Hernia Recurrence
	n	Mode (duration)	n	Type				
Condé-Green et al (14), 2013	23	Continuous -125 mmHg (5 days)	33	Dry gauze dressings	None (age, previous abdominal surgery, BMI, and pre-operative comorbidities)	Component separation in both groups Biologic matrix reinforcement in both groups	Component separation when primary fascial closure not possible Biologic matrix intraperitoneal underlay	
Pauli et al (15), 2013	49	Continuous -75 mmHg (7 days)*	70	Dry gauze dressings	NPWT group: lower ASA Physical Status Classification more component separations	Retro-rectus abdominus repair Synthetic mesh in clean fields and biologic matrix in contaminated fields	Large adipocutaneous flaps Component separation in all cases Synthetic mesh in all cases	
Olona et al (16), 2014	5	Continuous -125 mmHg (7 days)	37	N/A	None (in age and BMI)	Chevrel technique Synthetic mesh	Sandwich technique with sythetic mesh plus biologic matrix when fascial closure not possible	
Gassman et al (17), 2014	29	Continuous -125 mmHg (7 days)	32	dry occlusive dressings			NPWT group: more obese patients (21/29 versus 10/32) more cases with previous intra-abdominal infection (20/29 versus 9/32)	
Soares et al (18), 2014	115	Continuous -125 mmHg (3 days)	84	Dry gauze dressings			NPWT group: higher grade surgical wound classification according to CDC criteria, more anterior component separation	

Swanson, Edward W., et al. "Does negative pressure wound therapy applied to closed incisions following ventral hernia repair prevent wound complications and hernia recurrence? A systematic review and meta-analysis." *Plastic surgery* 24.2 (2016): 113-118.

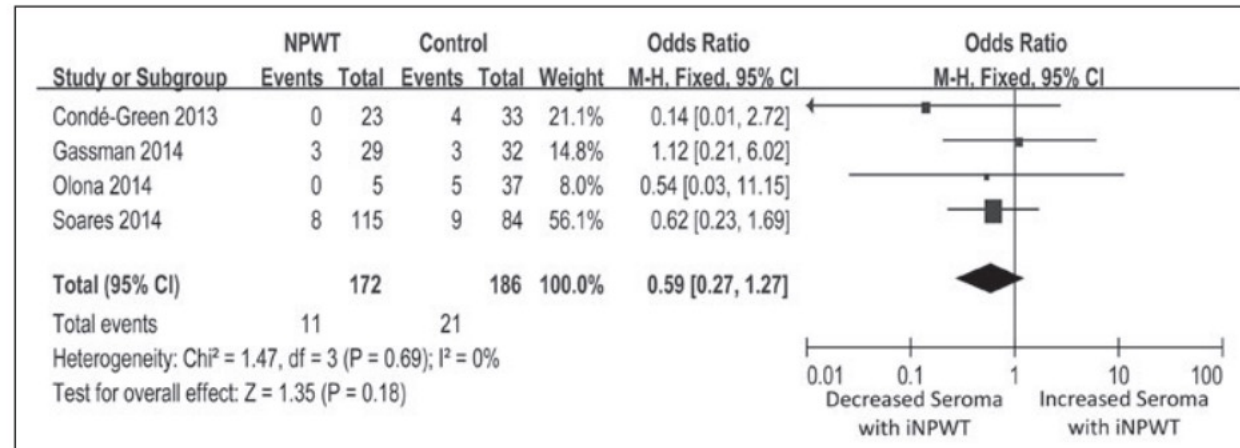
# MANAGING THE SUBQ

## WHAT IS THE EVIDENCE

SSI



Seroma

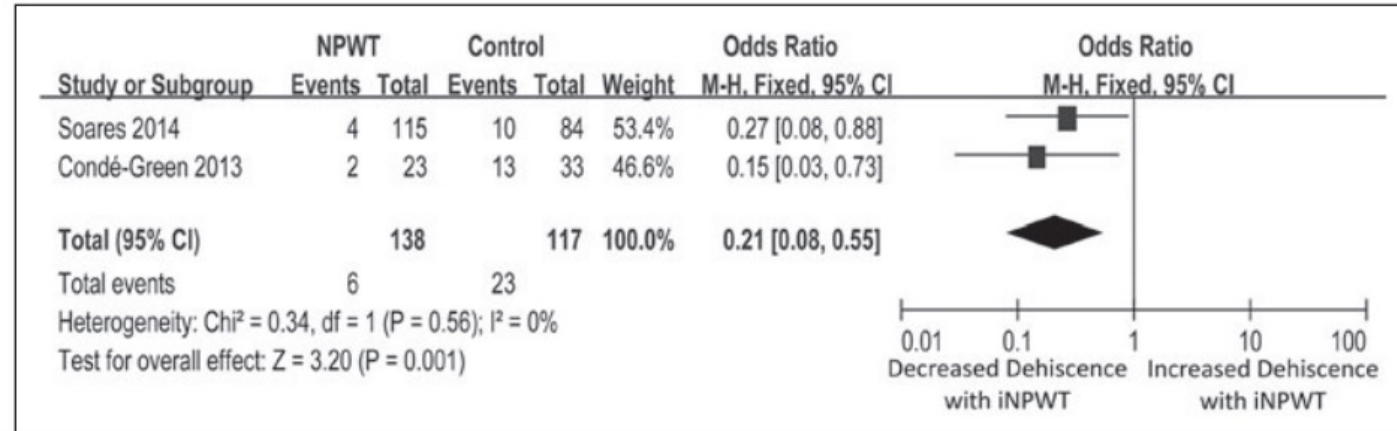


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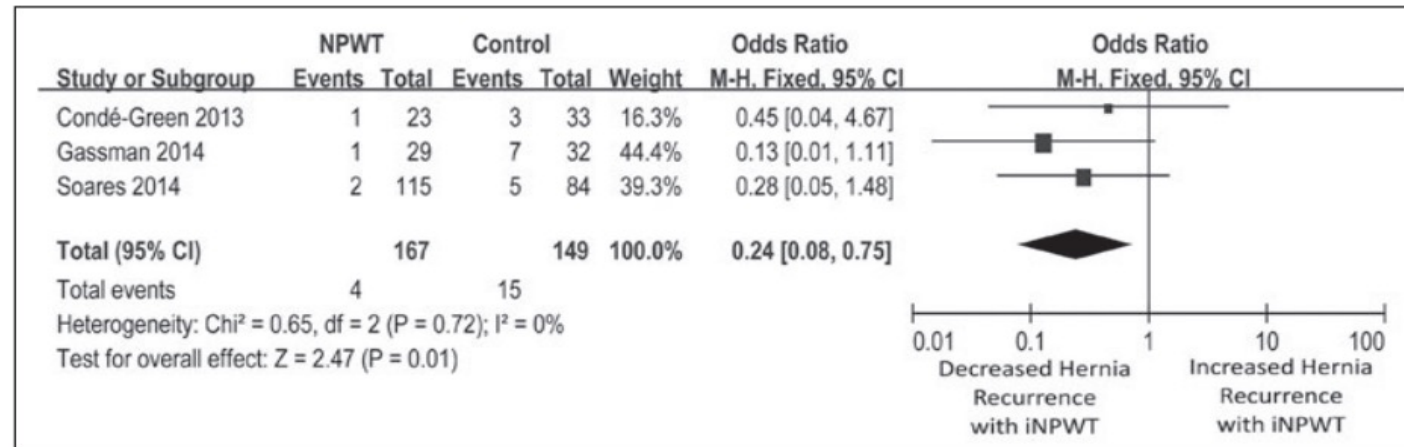
# MANAGING THE SUBQ

## WHAT IS THE EVIDENCE

Wound dehiscence



Hernia recurrence



Swanson, Edward W., et al. "Does negative pressure wound therapy applied to closed incisions following ventral hernia repair prevent wound complications and hernia recurrence? A systematic review and meta-analysis." *Plastic surgery* 24.2 (2016): 113-118.

# MANAGING THE SUBQ

## WHAT IS THE EVIDENCE

### Prophylactic Single-use Negative Pressure Dressing in Closed Surgical Wounds After Incisional Hernia Repair

*A Randomized, Controlled Trial*

**TABLE 3.** Risk Factors Related to SSI Development After Hernia Repair. Univariate Analysis

Variables	No Infection (%) N = 140	Infection (%) N = 6	Univariate P
Average age	53.6 ± 17.2	49.3 ± 19.4	0.121
Sex			
Male	84 (61.8)	2 (40)	0.112
Female	56 (38.2)	4 (60)	
Obesity (BMI >30)			
Yes	30 (21.3)	5 (100)	<b>0.002</b>
No	110 (78.7)	1	
Smoking			
Yes	57 (41.2)	3 (60)	0.401
No	83 (58.8)	3 (40)	
Diabetes			
Yes	41 (29)	4 (80)	0.092
No	99 (71)	2 (20)	
COPD			
Yes	29 (19)	2 (40)	0.432
No	111 (81)	4 (60)	
Immunosuppression			
Yes	12 (6.8)	2 (20)	0.091
No	128 (93.2)	4 (80)	
Anticoagulant therapy			
Yes	24 (17.5)	1 (20)	0.105
No	116 (82.5)	5 (80)	
ASA scale			
I-II	63 (45)	3 (60)	0.320
III-IV	77 (55)	3 (40)	
Repair techniques			
ACS	22 (17.5)	5 (80)	<b>0.001</b>
RSR	92 (62.5)	1 (20)	
PCS/TAR	26 (21)	0	
Use of PICO dressing			
Yes	67 (44.3)	0	<b>0.001</b>
No	64 (55.7)	6 (100)	
W2	80 (55.7)	1 (40)	0.333
W3	56 (44.3)	5 (60)	
Subcutaneous area dissection, cm <sup>2</sup>	133 ± 20.5	138 ± 30.3	0.129
Mean surgical time, min	131 ± 33	119 ± 41	0.541

Bueno-Lledó, José, et al. "Prophylactic single-use negative pressure dressing in closed surgical wounds after incisional hernia repair: a randomized, controlled trial." (2021): 1081-1086.

# MANAGING THE SUBCUTANEOUS SPACE

## FACTORS TO CONSIDER

- Hernia
- Wound
- Size of sac/su
- Depth space



- Patient factors



Immunosuppression

Originally optimized  
comorbidities

Previous/concurrent soft tissue  
infection

# MANAGING THE SUBCUTANEOUS SPACE

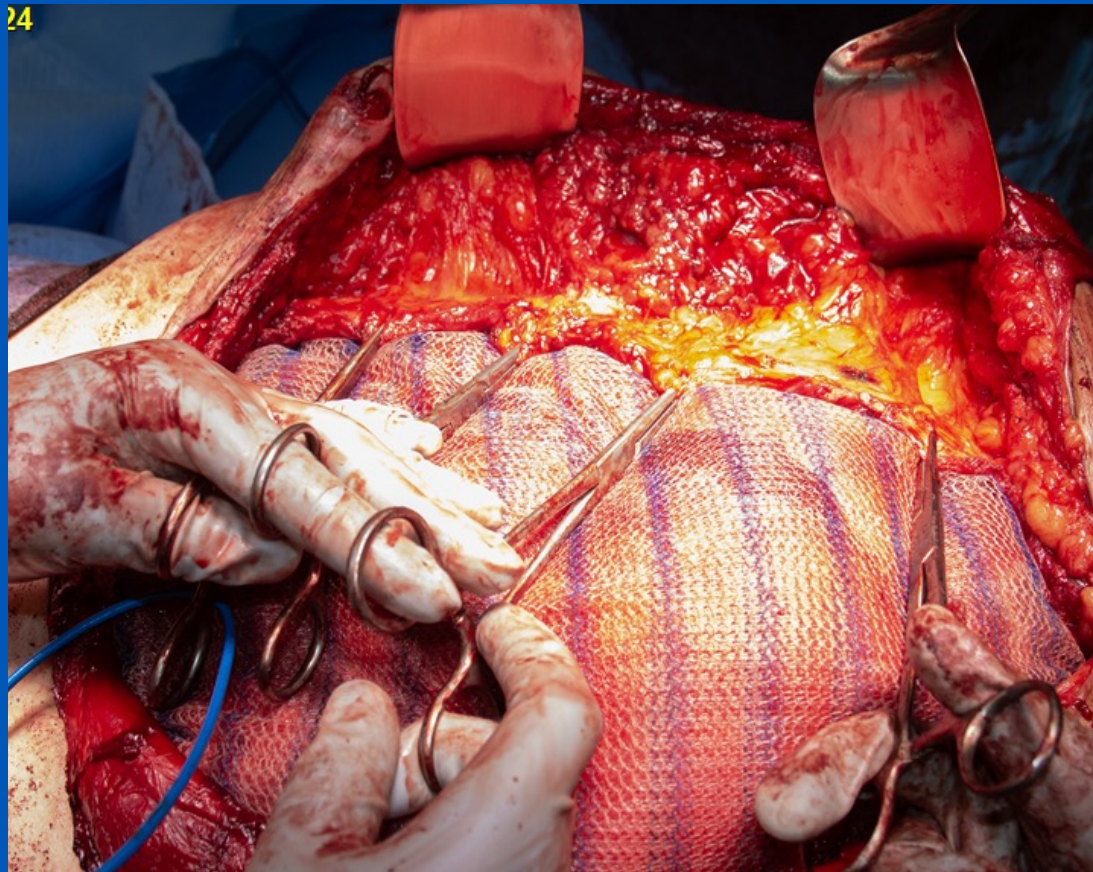
- Other factors to consider
  - Patient's social/care giver support
  - Distance to travel to provider
  - “Cost” of a wound event
  - Post-operative length of stay



# MY MANAGEMENT OF THE SUBCUTANEOUS SPACE

## 1. Freshening the Fascia

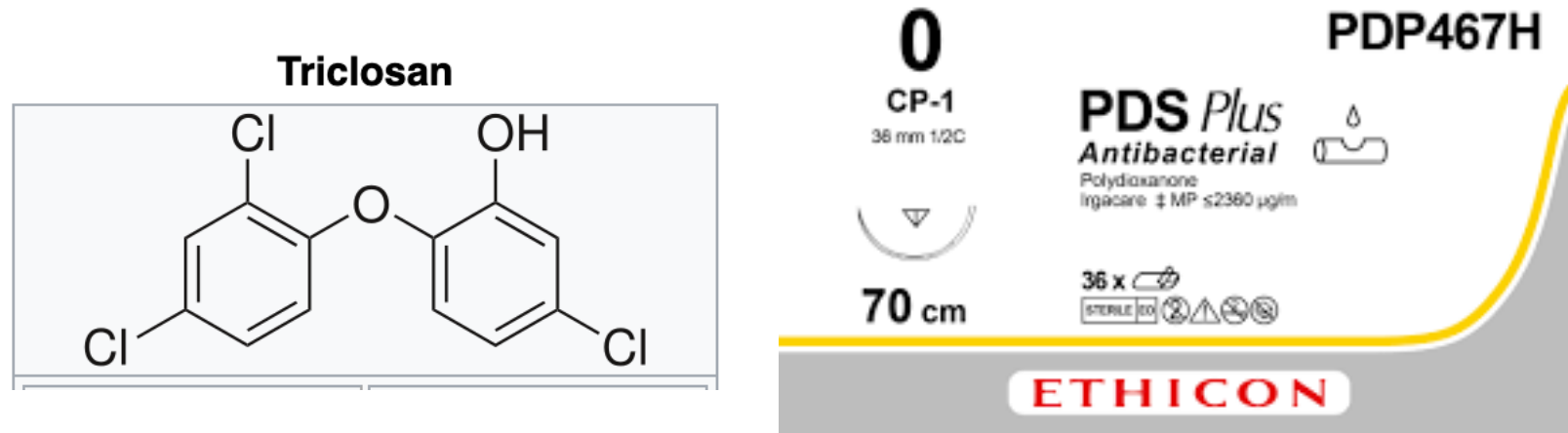
- unhealthy fascia is debrided back to healthy anterior fascia



# MY MANAGEMENT OF THE SUBCUTANEOUS SPACE

## 2. Fascial closure

- use of antibiotic coated sutures: Polydioxanone + Triclosan



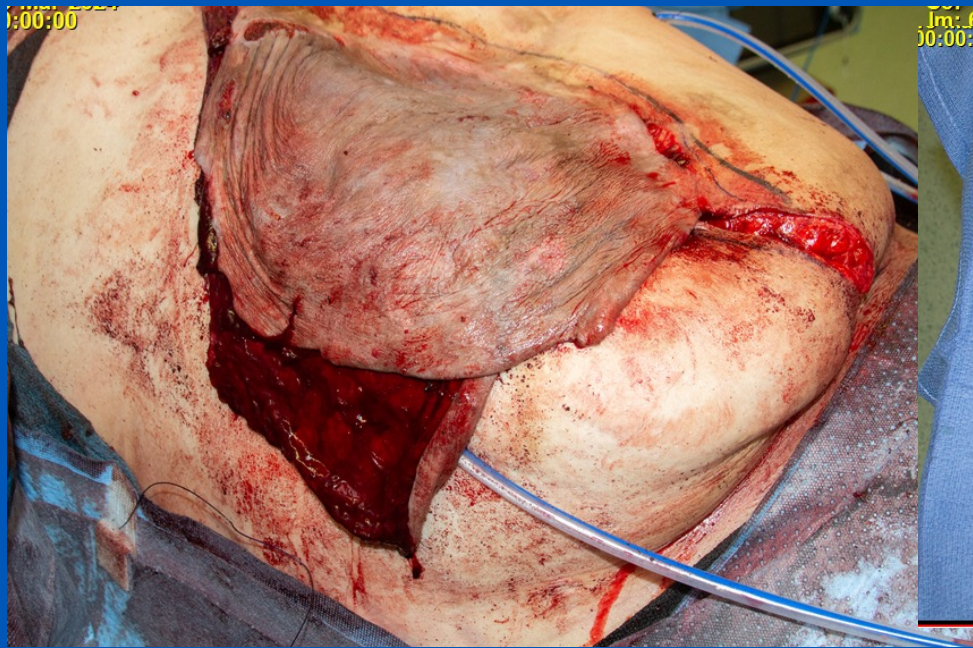
## Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017

Sandra I. Berríos-Torres, MD<sup>1</sup>; Craig A. Umscheid, MD, MSCE<sup>2</sup>; Dale W. Bratzler, DO, MPH<sup>3</sup>; et al

# MY MANAGEMENT OF THE SUBCUTANEOUS SPACE

## 3. Skin Resection

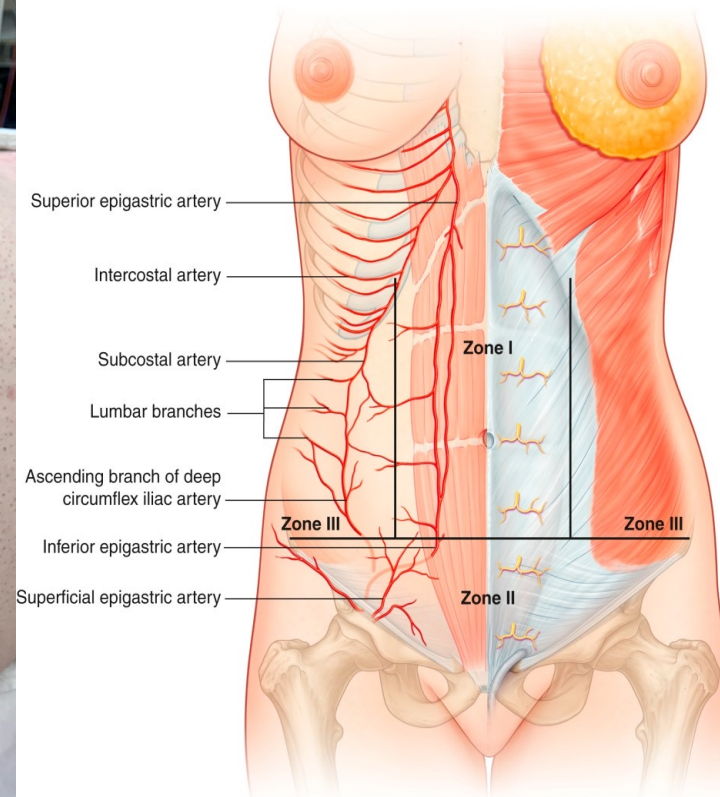
- resect all hernia sac, devascularized skin, resect to decrease subQ space



# MY MANAGEMENT OF THE SUBCUTANEOUS SPACE

## 3. Skin Resection

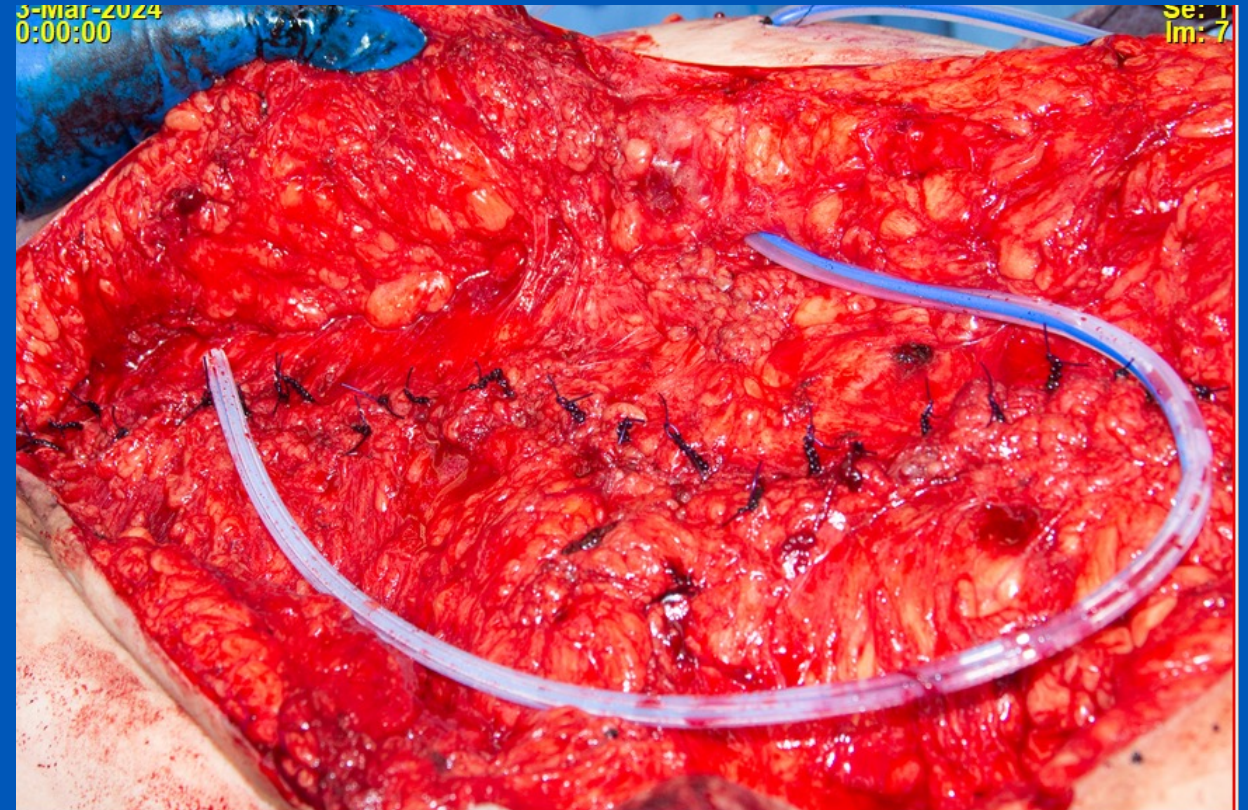
- resect all hernia sac, devascularized skin, resect to decrease subQ space



# MY MANAGEMENT OF THE SUBCUTANEOUS SPACE

## 4. Drain versus wound vac versus both

- Drain
  - Deep subcutaneous space
  - Need for immediate anticoag
  - Adequate outpatient support
  - Reliable outpatient follow up
  - Short LOS



# MY MANAGEMENT OF THE SUBCUTANEOUS SPACE

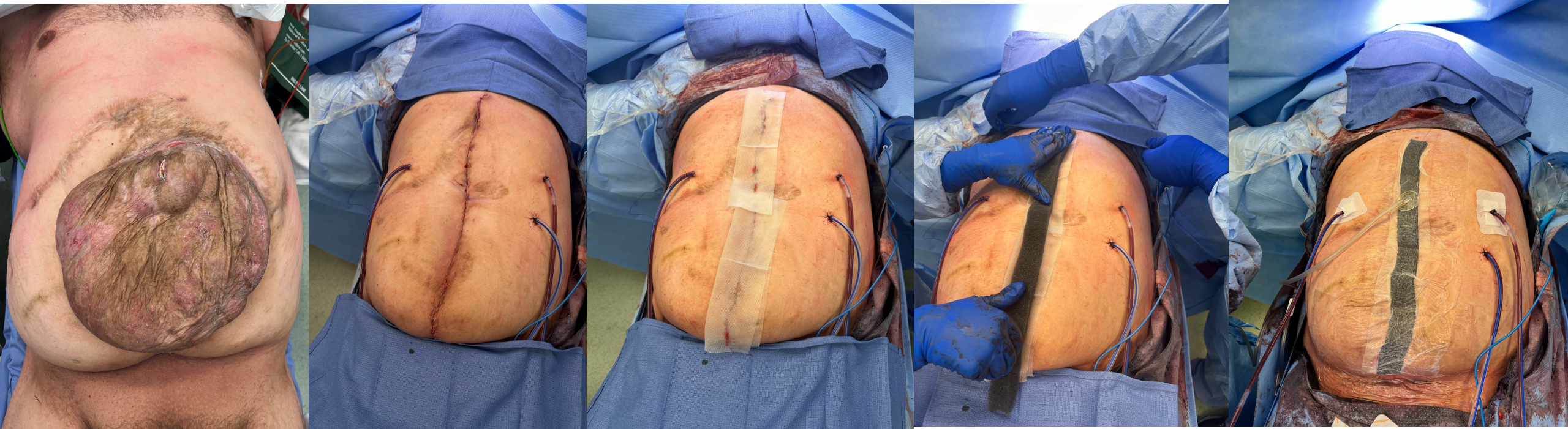
## 4. Drain versus wound vac versus both

- Wound vac
  - Longer LOS (5 days+)
  - Small subcutaneous space but “high risk” for SSO
    - Contaminated space
    - Questionable blood supply
  - Inadequate social support
  - Challenges to in person outpatient follow up



# MY MANAGEMENT OF THE SUBCUTANEOUS SPACE

## 4. Drain versus wound vac versus both



# MY MANAGEMENT OF THE SUBCUTANEOUS SPACE

## TAKE HOME POINTS

- 1. Aggressively manage the subcutaneous space
- 2. Resect to healthy - fascia and skin
- 3. Tailor your soft tissue management to increase patient compliance

# MY MANAGEMENT OF THE SUBCUTANEOUS SPACE

## TAKE HOME POINTS

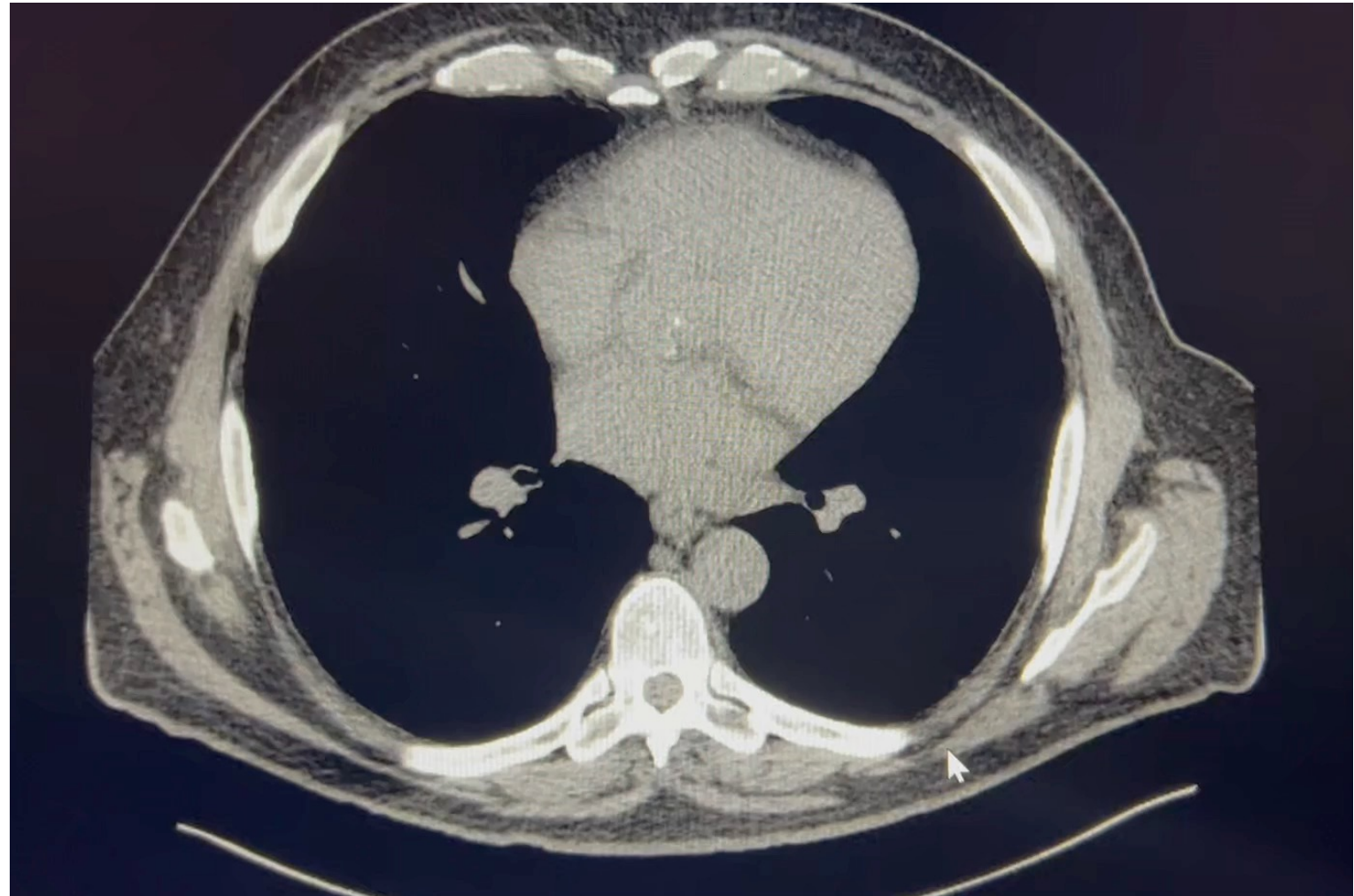
Sometimes you get it right.....



# MY MANAGEMENT OF THE SUBCUTANEOUS SPACE

## TAKE HOME POINTS

Sometimes you don't.....



# THANK YOU

